

ing loss of three lives and much valuable stock, near Van Buren. Little Rock, 3d, a severe storm burst over the city; many houses were blown down and unroofed; the wind reached a velocity of fifty-four miles per hour, and for ten minutes, it blew at the rate of sixty-six miles per hour. On the 12th, a storm of short duration occurred, several buildings in the suburbs were unroofed and otherwise damaged. Texarkana, 12th, a severe hurricane passed over this place about 7 p. m. A large three story building was blown over, falling upon a frame building in which a number of persons had congregated; more than twenty persons were buried in the ruins. Several sheds and out-buildings were destroyed, and considerable damage was done to other property in the town.

*Colorado:* A severe storm occurred at Manitou, El Paso county, on the 1st. The storm was accompanied by hail and torrents of rain; bridges, fences, and trees were carried away, and houses standing on the banks of the streams were flooded, or swept away. Many houses in Manitou were more or less damaged, and the loss of horses and cattle amounted to several thousand dollars.

*Delaware:* During a heavy gale at Delaware Breakwater on the 4th, the schooner "Eden" lost mainmast.

*Dakota:* On the 14th, a violent storm of wind, hail, and rain, swept over the Redwater and Spearfish valleys, in Lawrence county. The path of the storm was about four miles wide, and moved in a northerly direction for a distance of about thirty miles. All the crops in the track of the storm, were destroyed; it is estimated that crops covering an area of 2,000 acres were entirely destroyed.

*Iowa:* A tornado appeared near Nora springs about 5.30 p. m. of the 17th. The tornado cloud was funnel-shaped, and appeared to be several hundred feet high. It first struck the earth near Shell Rock river, and took a northeasterly path through an adjoining farm, tearing up crops and fences, and injuring barns and other property. The width of the storm-path was about two rods. After leaving Nora Springs the tornado passed into Mitchell county.

*Kansas:* A tornado swept through Cherokee and Crawford counties about 5.30 p. m. of the 5th, and was accompanied by large hail and heavy rain, and caused great damage to crops and property. Trees were uprooted and stacked grain was scattered in all directions. Near Columbus several houses and barns were completely demolished, and many others were unroofed or otherwise damaged; several persons were injured, some severely. In Crawford county houses, barns, fences and crops were laid low, and several persons were severely injured. A very heavy wind storm passed over Marysville, Marshall county, at 10 a. m. of the 11th; telegraph wires were prostrated, and much damage resulted to the town. At Waterville several barns and dwellings were blown down, and stacked grain was scattered. The storm passed eastward into Nemaha county and was accompanied by heavy hail; at Centralia a school house was unroofed and a church steeple badly damaged; two large barns were blown down, and several houses were more or less damaged. The fruit crop suffered severely. Atchison, 11th, a tornado visited this place at about 11 a. m., and was probably a continuation of the storm above referred to. Houses and barns were blown down, and trees, fences and signs were carried away; at Farmington, fruit and corn were cut down and several buildings were leveled. At Effingham, chimneys, out-houses, fences and trees were generally leveled, and in the surrounding country several farm houses were more or less damaged, the inmates receiving, in some cases, severe injury. A tornado occurred in Pratt county on the night of the 12th. Five houses were blown down at Iuka, and several other buildings were badly damaged; in the country many barns were blown down, several persons were injured—some fatally—and the crops were destroyed in a belt of country four miles wide. A tornado also appeared in Rice county on the 16th; the storm struck Eureka township, where it did much damage, carrying away wheat stacks and unroofing dwellings. Near Kansas Centre the storm was very severe, several farm

houses being demolished, and the crops entirely destroyed. The loss in the county amounted to several thousands of dollars.

*Missouri:* A destructive wind and rain storm visited Saint Joseph at noon of the 11th. Many buildings were damaged and trees uprooted and broken, and several workmen were injured by being blown off the buildings in course of construction. The storm lasted twenty minutes, being followed by heavy rain. Independence, 11th, a tornado cloud, accompanied by strong wind and heavy thunder and lightning, passed over the town; it was followed by heavy rain, but no damage was done. At Protom, a severe storm occurred at 11.35 p. m. of the 11th, fields of corn were leveled to the ground, and much damage was done to orchards, many trees being uprooted. A heavy rain and thunder storm occurred at Springfield on the 11th, the wind reaching a velocity of forty-eight miles per hour. The damage to the city was slight.

*Minnesota:* During the evening of the 25th, a severe storm accompanied by loud thunder and vivid lightning, occurred at Saint Paul. Two unfinished buildings in the city were demolished, and a portion of the railing of the bridge spanning the Mississippi river was blown off, and many trees were uprooted. Reports from the surrounding country stated that the storm was very severe.

*Nebraska:* A destructive storm passed over southwestern Nebraska on the morning of the 11th, and was accompanied by heavy hail, which caused great damage to crops. The wind in some places attained the force of a hurricane, and at Hastings, Adams county, many buildings were unroofed, and a large number of windows were broken by the large hail-stones. At Glenville, Clay county, several houses were blown down, and the depot of the Saint Joseph and Western railroad was demolished.

*North Carolina:* 28th, a tornado occurred at Nag's Head, ten miles south of Kittyhawk; the hotel was partially unroofed; heavy timbers were taken up and carried some distance.

*Ohio:* Cincinnati, 4th, during a heavy wind storm, several houses in the suburbs were unroofed and chimneys blown down, but no damage occurred in the city. A wind and rain storm passed over Marietta on the night of the 10th; corn was broken down, and more or less damage resulted to property.

*Pennsylvania:* 15th, a storm occurred during the evening, in Allegheny county; fences and trees were blown down, and a tow-boat was capsized. On the afternoon of the 19th, a heavy wind and rain storm passed over the northern section of Lancaster county. In Columbia, trees and signs were blown down and the streets were obstructed by debris. Much damage was done to boats on the canal, and several persons were injured by flying debris.

*Texas:* A severe storm occurred at Jacksboro, about midnight of the 17th. Four buildings were unroofed, and the iron roof of the jail was blown off. The wind reached a velocity of fifty-four miles per hour. A violent storm of wind and rain occurred in Travis county, about ten miles north of Austin, on the afternoon of the 20th. Houses and barns were unroofed, and the corn and cotton crops in the track of the storm were destroyed. On the 21st, a heavy wind storm also occurred in Shackleford county, damaging one building and uprooting hundreds of trees.

## VERIFICATIONS.

### INDICATIONS.

The detailed comparison of the tri-daily indications for July, 1882, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 90.5 per cent. The percentages for the four elements are: Weather, 92.6; Direction of the Wind, 89.2; Temperature, 90.6; Barometer, 89.8 per cent. By geographical districts they are: For New England, 91.0; middle Atlantic states, 91.8; south Atlantic states, 91.4; east Gulf states, 92.2; west Gulf states, 92.5; lower lake region, 91.1;

upper lake region, 88.7; Tennessee and the Ohio valley, 90.7; upper Mississippi valley, 90.0; lower Missouri valley, 86.5; northern Pacific coast region, 83.3; middle Pacific coast region, 90.3; southern Pacific coast region, 90.3.

There were 50 omissions to predict (13 being due to the absence of reports from the Pacific coast) out of 3,813, or 1.31 per cent. Of the 3,763 predictions that have been made, 29, or 0.77 per cent., are considered to have entirely failed; 64, or 1.70 per cent., were one-fourth verified; 232, or 6.17 per cent., were one-half verified; 645, or 17.14 per cent., were three-fourths verified; 2,793, or 74.22 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

#### CAUTIONARY SIGNALS.

Seven cautionary signals were displayed during the month of July, of which the total number, or 100 per cent, were justified by winds of twenty-five miles per hour, at or within one hundred miles of the station. No off-shore signals were displayed.

One-hundred and fifteen winds of twenty-five miles, or more, per hour, were reported, for which no signals were ordered; many of these were local storms or strong sea-breezes, for which no signals were required. One Signal was reported late.

#### NAVIGATION.

##### STAGE OF WATER IN RIVERS.

In the table on the right-hand of chart number iii., are given the highest and lowest stages of water observed at Signal Service stations during the month of July, 1882. In the first column of this table are given the heights of water on the gauge, which have been dangerous to property at stations.

The upper Mississippi river, from Keokuk to Cairo, reached its highest stage between the 1st and 9th. At the former station, on the 1st, the water rose to fifteen feet and seven inches, or thirteen inches above the danger line. At Saint Louis, the highest water, thirty-two feet and five inches, or twenty-five inches above the danger line, occurred on the 5th. On the 8th and 9th, at Cairo, the water rose to within fourteen inches of the danger line. At Vicksburg, the river continued falling throughout the month. The water remained at the danger line on the 1st and 2d; and at the close of the month was five feet and nine inches below the danger line. The highest water in the Missouri river occurred from the 1st to the 3d; and in the Ohio river, from the 1st to the 8th.

#### FLOODS.

**Missouri:** Kansas City, 2d, the Missouri river overflowed its banks and completely flooded the surrounding country, doing severe damage to crops. In many places farmers left their homes, fearing a general washout. The damage to crops is estimated at \$50,000. Proteem, 3d, heavy rains caused an overflow in Bear and Bee creeks, Boone county. A thickly settled farming region was flooded; fields of corn and cotton were destroyed, fences swept away, and a quantity of shocked wheat was seriously damaged. 8th, a creek about twenty miles south of Proteem overflowed from the effects of a heavy rain; horses, cattle and crops were swept away and lost.

**Saint Louis,** during the 3d, 4th and 5th the Mississippi river was from one foot, six inches to two feet, five inches above the danger-line. Large tracts of bottom-lands were submerged, and lumber-yards and other property along the river suffered considerable damage. The damage to crops is estimated at \$20,000.

**Saint Joseph,** 18th, heavy rains caused damaging floods, which swept away many small buildings, and caused damage to sewers and other city property to the amount of \$5,000. Much damage also occurred to shocked wheat and to the oat crop, which was ready to harvest.

**Ohio:** Lebanon, 10th, a flood in Turtle creek caused damage to four houses situated on the banks of the creek, and the furniture was swept away and lost. Columbus, 10th, during a

heavy rain-storm cellars in the northern part of the city were flooded.

**Illinois:** Alton, 1st, a rise in the Mississippi river caused floods in bottom lands, and ruined many fields of wheat. Several buildings near the river front were damaged.

**New York:** New York City, 5th, a heavy rain storm flooded the streets and cellars in some sections of the city.

**Massachusetts:** Boston, 19th, the basements of many houses were flooded during a very heavy rain storm on the afternoon of the above date.

**Texas:** Coleman City, 9th, a heavy rain caused the creek to rise fifteen feet; bottom-lands were flooded and fences carried away; vegetable crops were much damaged.

#### TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the right-hand of chart number ii. In the first column of the table is given the maximum temperature observed during the month; and in the second column the minimum temperature observed during the same period.

The following table gives the highest and lowest temperature of water at the several stations, with the range of water temperature, mean temperature of the air at the station, and the depth of water at which the observations were taken. It will be seen that the greatest ranges are as follows: 18° at Chincoteague; 17° at New Haven; 15° at Newport; 15° at Duluth. The smallest are: 3° at Port Eads; 4° at Smithville; 4° at Savannah; 5° at Baltimore:

Temperature of Water for July, 1882.

STATION.	Temperature at bottom.		Range.	Average depth in feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
Atlantic City.....	74.5	64.8	9.7	6 9	73.3
Alpena.....	71.8	60.8	11.0	12 0	63.9
Augusta.....	87.5	78.8	9.0	6 0	79.2
Baltimore.....	80.5	75.5	5.0	9 10	76.6
Block Island.....	67.9	67.9	10.0	8 9	69.9
Boston.....	69.	60.6	8.5	25 0	71.7
Buffalo.....	74.7	64.7	10.0	10 0	67.3
Burlington.....	76.	61.3	14.7	19 0	.....
Cedar Keys.....	86.	80.	6.0	10 1	81.5
Charleston.....	84.9	78.7	6.2	40 6	81.3
Chicago.....	69.5	61.4	8.1	7 10	68.6
Chincoteague.....	86.	68.	18.0	6 0	74.2
Cleveland.....	77.	67.5	9.5	14 0	68.7
Detroit.....	73.	66.	7.0	24 0	70.1
Duluth.....	60.	46.	15.0	14 3	61.9
Delaware Breakwater.....	73.3	61.5	11.8	6 6	72.6
Eastport.....	48.2	42.9	5.3	18 2	61.6
Escondido.....	69.	59.6	9.5	15 0	64.6
Galveston.....	86.	78.	8.0	14 6	82.9
Grand Haven.....	78.5	66.6	7.0	19 0	66.5
Indianola.....	66.8	82.4	4.4	9 3	83.0
Jacksonville.....	88.	82.	6.0	18 0	80.9
Key West.....	90.2	82.8	7.4	15 9	85.0
Marquette.....	67.8	51.9	5.9	10 6	62.9
Milwaukee.....	63.5	49.5	14.0	8 0	66.0
Mobile.....	86.3	79.	7.3	15 9	78.6
New Haven.....	79.8	62.5	17.3	15 2	71.6
New London.....	71.	59.	12.0	12 4	71.2
Newport.....	72.4	56.7	15.7	12 0	70.0
New York.....	76.5	65.	11.5	21 7	78.8
Norfolk.....	84.	75.	9.0	16 11	77.9
Pensacola.....	83.	79.8	3.2	17 9	78.5
Portland, Me.....	61.5	61.	10.5	18 10	71.4
Portland, Oreg.....	71.5	62.2	9.3	74 8	65.3
Port Eads.....	82.	79.	3.0	9 7	80.4
Provincetown.....	.....	.....	.....	.....	.....
Punta Rasa.....	80.	83.	7.0	11 10	80.4
Sandusky.....	76.8	68.	8.8	10 0	70.2
Sandy Hook.....	74.3	66.3	9.0	1 7	75.0
San Francisco.....	63.6	57.6	6.0	30 7	68.4
Savannah.....	86.2	81.8	4.4	13 1	81.5
Smithville.....	84.	80.	4.0	10 0	79.3
Thatcher's Island.....	68.7	56.	12.7	7 0	68.3
Toledo.....	78.5	69.5	9.0	11 11	71.8
Wilmington.....	86.5	80.5	6.0	13 0	78.0

\*Observations wanting, from 1st to 26th, inclusive.

#### ATMOSPHERIC ELECTRICITY.

##### AURORAS.

The most important display of the month occurred on the evening of the 16th. It was observed from Eastport Maine,